NASA SBIR/STTR Technologies

NNX13CK04C

E1.02-9091 - Incremental Evolution of a 10/250 NLV into a 20/450 NMSLV

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Identification and Significance of Innovation

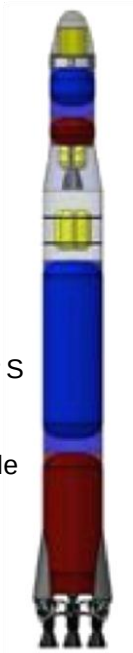
Phase I design studies combined with results from parallel projects have resulted in a major improvement in the design for a cost-effective "20/450" NMSLV that can place 20 kg into a circular 450 km low Earth orbit. Changing the first stage configuration from a cluster of smaller core boosters to a single booster with larger propellant tanks reduces the recurring cost of production. This also simplifies launch operations and the design of the associated transporter-erector-launcher.

Vehicle-level static fire testing was achieved during Phase I by aggressive leveraging of design heritage and test data from a previous SBIR project and the NASA HALS and SLSI programs. These tests validated a new main valve assembly (MVA) and thrust vector control (TVC) assembly for the NMSLV first stage engine. This design and operational experience now provides a firm foundation for a high altitude flight test attempt in Phase II.

Estimated TRL at end of Phase II contract: 7 - 8

Phase I
Stage 1 Engine
MVA / TVC
Static Fire Test

Phase II
Prospector S
Suborbital
Pathfinder
Test Vehicle



Technical Objectives and Work Plan

The successful implementation of the new first stage engine MVA and TVC assemblies makes it possible to attempt a high performance pathfinder flight with a two stage NMSLV prototype, the Prospector S ("P-S"), in Phase II.

The Phase II work plan includes finalizing the design of this test vehicle, with the propellant tanks being a center of focus. The subsequent vehicle assembly, integration and test (AIT) phases then pathfind the NMSLV production process and firm up cost modeling. To the extent possible, the avionics system will incorporate capabilities developed under parallel SBIR-sponsored projects.

For the launch task, Phase I trades have converged on ocean-based launch as the reference for the P-S mission concept of operations (CONOPS) to simplify range safety requirements. This enables shifting the need for a flight termination system to a later point in the program, thereby allowing more near-term resources to go into core NMSLV development and validation.

The P-S CONOPS takes advantage of lessons learned from Sea Launch, such as keeping the launch control function on land rather than sending it out to sea to be in proximity with the launcher. A final decision on this CONOPS versus a land-based approach is one of the main project decisions to be made by PDR.

NASA and Non-NASA Applications

Expand upon current launch services to provide additional suborbital technology flight opportunities for CubeSat and nanosat-class payloads, enabling TRL 6 to 8 evaluations

Provide dedicated, responsive, cost-effective NMSLV orbital launch services for NASA LSP's ELANA initiative and the Edison small sat project.

Complement and support the NEXT class of missions

Launch global CubeSat constellations for commercial operators like Planetary Labs, followed by periodic replacements

Launch ORS satellites for the DOD Office of Operationally Responsive Space

Launch science satellites for the National Science Foundation

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